APPLICATION

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TITLE: METHOD AND APPARATUS TO DISPLAY THE APPEARANCE
                OF A DOCUMENT

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METHOD AND APPARATUS TO DISPLAY THE APPEARANCE OF A DOCUMENT

Background

5   The present invention relates generally to the creation and display of electronic

documents, and more particularly to the creation and display of electronic documents that

accurately depict hard copy documents.

Electronic documents are stored on computer-readable media (e.g., computer memory or

disks) and typically contain content (e.g., text, graphics and image data) and formatting

10   information (e.g., page size and margins). Electronic documents can be stored, retrieved,

displayed, and exchanged by computer users. Electronic documents are created by authors and

publishers who may desire that the documents be viewed with a particular appearance. The

Acrobat™ family of products from Adobe Systems Incorporated, of San Jose, California,

enables authors and publishers to create, modify, exchange, and view electronic documents in a

15   platform-independent manner. Acrobat™ makes use of a document description language (DDL)

called Portable Document Format™ (PDF) which describes a document in a manner

independent of the application software, hardware, and operating system used to create it. A

PDF document has one or more pages, each containing any combination of text, graphics, and

images in a device and resolution-independent format.

20   Although electronic documents have advantages, including their ease of transmission,

compact storage, and ability to be edited, hard copy documents, such as paper documents,

continue to be used. In fact, many electronic documents are used only for the eventual

production of hard copy documents. Although current desktop publishing programs provide

users with the ability to create and modify the content of electronic documents easily, the final

25   form of assembled hard copy documents, for example, as provided by a document assembler

(e.g., a printing or copier shop), will often vary from the intended appearance.

Summary

In one aspect, the invention is directed to a method of depicting a hard copy document.

30   A first electronic document is received in a computer. A user input that selects an instruction for

assembling a hard copy document is also received in a computer. A visual appearance of the

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first electronic document once printed and assembled in accordance with the instruction is determined in the computer, and the determined visual appearance is produced as output.

In another aspect, the invention is also directed to a computer program, tangibly stored on a computer-readable medium, comprising instructions for causing the computer to carry out this method.

Implementations may include the following. A second electronic document may be generated which depicts the first electronic document once printed and assembled in accordance with the instruction, and the second electronic document may be displayed. A second user input may be received that selects a second instruction for assembling the hard copy document, and a modified second electronic document may be generated which depicts the first electronic document once printed and assembled in accordance with the first and second instructions. A copy of the first electronic document may be modified, e.g., by adding a tile depicting a change in the visual appearance resulting from the instruction to a page of the first electronic document, to generate the second electronic document. The tile may be retrieved from a database which associates a plurality of instruction identifiers with a plurality of tiles. The database may include an entry for each instruction identifier, each entry including an instruction name and a first tile associated with a front page of the hard copy document, a second tile associated with an inside right page of the hard copy document, a third tile associated with an inside left page of the hard copy document, and a fourth tile associated with a final page of the hard copy document. Retrieving the tile may include determining whether the page of the first electronic document is a first page, an inside right page, an inside left page, or a final page, and selecting the tile based on this determination. Modifying the copy of the first electronic document may include inserting a page into the first electronic document, and adding a tile depicting a change in the visual appearance resulting from the instruction to the inserted page of the first electronic document, and retrieving the tile may include determining whether the cover sheet is a first page or a final page, and selecting the tile based on this determination. The user input may be received from an electronic file through an interactive user interface. Receiving the user input may include displaying a plurality of instruction identifiers in a document assembly form on a display, and receiving a user input selecting one of the instruction identifiers. The instruction may identify a printing media to be used in the hard copy document, such as the weight, color, texture, or

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transparency of the printing media, a preexisting image on the printing media, a cover to be used in the hard copy document, a binding to be used in the hard copy document, such as a velo tape, spiral, multi-ring, comb, magazine style, or stapling binding, or a physical modification of a

5   printing media used in the hard copy document, such hole punching, folding or cutting of the printing media.

In another aspect, the invention is directed to a method of displaying a finished form of a hard copy document. An electronic document is received and stored in a computer. A user input that selects an instruction for assembling a hard copy document corresponding to the electronic

10   document is received in the computer. A second electronic document which depicts the visual appearance of the first electronic document once printed and assembled in accordance with the instruction is generated, and the second electronic document is displayed.

In another aspect, the invention is directed to a computer-assisted method of creating a hard copy document. An electronic document and user input that selects an instruction for

15   assembling a hard copy document are received. A visual appearance of the electronic document once printed and assembled in accordance with the instruction is depicted, and the electronic document and the user input are provided to a document assembler.

Implementations may include the following. The document assembler may print the electronic document to create the hard copy document, and assemble the hard copy document in

20   accordance with the instructions corresponding to the user input. A second electronic document may be generated which depicts the visual appearance of the hard copy document assembled in accordance with the instruction.

The advantages of the invention may include the following. The visual appearance of an assembled hard copy document may be accurately depicted by an electronic document. The user

25   can experiment to determine the most aesthetically pleasing visual appearance of the assembled hard copy document, and can avoid the high cost of printing that would otherwise be associated with assembling the hard copy document. In addition, the reliability of the production process is improved because both the user and the document assembler have access to both a written and visual description of the document assembly parameters.

30   Other advantages will become apparent from the following description, including the drawings and the claims.

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Brief Description of the Drawings

FIG. 1 is a flow diagram illustrating a method performed by a user for creating and viewing an augmented electronic document.

FIG. 2A is an illustration of the step from FIG. 1 of creating an electronic document.

FIG. 2B is an illustration of the step from FIG. 1 of converting an electronic document to PDF format.

FIG. 2C is an illustration of the step from FIG. 1 of selecting document assembly parameters.

FIGS. 2D-2F are illustrations of the step from FIG. 1 of displaying an augmented electronic document.

FIG. 3 is a schematic illustration of a computer system that may be used to perform the methods of FIGS. 1 and 5.

FIG. 4 is a schematic block diagram of a virtual document assembly program that may be used to perform the methods of FIGS. 1 and 5.

FIG. 5 is a flow diagram illustrating a method performed by a computer system for creating and displaying an augmented electronic document.

FIG. 6 is a flow diagram illustrating the step from FIG. 5 of modifying an augmented electronic document.

Detailed Description

The present invention provides a method for an author or publisher to create and view an "augmented electronic document", i.e., an electronic document that accurately depicts an assembled hard copy document. In brief, after creating an original electronic document, the author or publisher uses a virtual document assembly program to select the instructions, e.g., the desired binding, stapling, or hole punching, that would be given to a document assembler. As the instructions are selected, the virtual document assembly program adds instructions to the electronic document so that, when it is rendered, indicia of the assembly are seen. Thus, the virtual document assembly program generates an augmented electronic document that depicts the finished form of the document. That is, the augmented electronic document depicts a hard copy document having the same content as the original electronic document, but assembled according

to the selected instructions. The augmented electronic document may be provided to a document assembler who will print the original electronic document and assemble it according to the instructions. Since both the author or publisher and the document assembler can view the same augmented electronic document, the final form of the assembled paper document should have the appearance intended by the author or publisher. The augmented electronic document may be stored in a device and resolution-independent format, such as PDF.

Referring to FIG. 1, a method 10 for creating and viewing an augmented electronic document begins when a user creates a source document (step 12). For example, the user may create a source document using a word processor, a page layout program, or a desktop publishing program. The source document will contain traditional content, such as text, graphics and image data. In addition, the source document may include formatting information that is traditionally associated with the printing of the document, for example, on a laser printer or ink jet printer. For example, the formatting information may include the page size, margins, page numbering and line numbering. Referring to FIG. 2A, a source document 100 is displayed within a window 102 on a computer screen 104.

Once the source document has been created, the user converts it into a portable document format (PDF) document (step 14 in FIG. 1). For example, the PDF document can be created by using a PDF printer driver to "print" the document as a PDF formatted file to a disk. This process of creating a PDF document from an original document is practiced by the aforementioned Acrobat™ products. The PDF document 106 has the same formatting and appearance as the original source document after it has been printed, but before it has been assembled. Then the user opens the PDF document with a virtual document assembly program (step 16). The virtual document assembly program re-displays the PDF document for viewing by the user. Referring to FIG. 2B, the source document has been converted into a PDF document 106 that is shown within a window 108 on the computer screen 104.

Returning to FIG. 1, the user then uses the virtual document assembly program to select one or more document assembly parameters (step 18). The document assembly parameters correspond to features that the user desires in the assembled hard copy document. For example, the user may select various features associated with aspects of the printing media, such as the weight, color, texture, transparency, shape or orientation of the printing media. In addition, pre-

existing images on the printing media, such as watermarks, borders, engravings or designs, may be selected by the user. The user may select features associated with the front and back cover of the augmented electronic document, such as the material (e.g., paper, plastic, etc.,), weight,

5   color, or texture of the front or back cover. The user may insert extra papers or sheets into the document, such as end papers, interleaved blank sheets, and index tabs. The user may also select the binding of the augmented electronic document, such as velo™ binding, tape binding, spiral binding, stapling, multi-ring binder, comb binding, or magazine style binding. For each type of binding, there may be a variety of options, such as the color, pitch and direction of spiral of a

10   spiral binding, or the location of a staple. Finally, the user may select parameters associated with physical modification of the printing media, such as hole punching (including the number and location of drill holes), folding (including the number and direction of folds), and cutting (including the number and direction of cuts).

        The user may select the document assembly parameters from a document assembly form displayed by the virtual document assembly program. Referring to FIG. 2C, a document

15   assembly form 112 is displayed in a window 114 on the computer screen 104. The user may select document assembly parameters by clicking or typing in controls 110 on the document assembly form 112, such as check boxes, text boxes, combo boxes and radio buttons. In addition, the user may make selections from a pull-down menu 116.

20   Once the document assembly parameters have been selected, the user views the augmented electronic document (step 20 in FIG. 1). The appearance of the augmented electronic document will be based on the previously selected document assembly parameters, such as the paper color, paper thickness, binding type, front and back cover material. For example, referring to FIG. 2D, the user may view a cover sheet 122 of an augmented electronic document 120.

25   Assuming that the user selects stapling and three-hole punching, a graphic 124 illustrating a staple is positioned where the staple will be place, for example, in an upper left-hand corner of the cover sheet 122, and graphics 126 illustrating punch marks are positioned along the left side of the cover sheet 122. In addition, graphics 128 illustrating the thickness of the assembled document are added to the lower and right-hand sides of the cover sheet 122. The illustrated

30   thickness is based on the number of pages in the PDF document (plus any inserted pages). Referring to FIG. 2E, the user may also view two interior pages 130 and 132 of the augmented

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electronic document 120. The interior pages 130 and 132 include graphics 126 to illustrate the three-hole punch marks, graphics 134 creating obscured regions where the staple would secure the pages, and text 136. By visually inspecting the appearance of the augmented electronic

5   document 120, the user may be able to note errors or unaesthetic elements that would be present in the assembled hard copy document. For example, the user may note that the punch marks will obscure a portion of the text, and therefore either the margins of the text will need to be changed or the three-hole punching will need to be eliminated. Finally, referring to FIG. 2F, the user may view the back cover 140. The back cover 140 includes graphics 142 illustrating the prongs of

10   the staple, and graphics 126 illustrating punch marks along the left edge of the back cover 140.

Returning to FIG. 1, after viewing the assembled document, the user may add, delete, or change the document assembly parameters (step 22) and then view the modified augmented electronic document (returning to step 20). Thus, the user may experiment and inspect the appearance of the augmented electronic document with different sorts of bindings, paper

15   weights, etc., without the associated printing costs. Finally, when the augmented electronic document has the desired appearance, the user may save the original electronic document with an associated file or addendum containing the document assembly parameters (step 24). In addition, the user may save the augmented electronic document as a separate PDF file. Since the augmented electronic document is a conventional PDF file, it may be displayed with a

20   conventional PDF document viewer.

The user may provide the original electronic document with the associated document assembly parameters to the document assembler who will use the document parameters. The document assembler prints the original electronic document, and extracts the document assembly parameters from the associated file or addendum. The document assembly parameters are then

25   used as instructions for assembling the hard copy document. In addition, the document assembler may use the virtual document assembly program to create a new augmented electronic document. However, since the two augmented electronic documents are created with the same document assembly parameters, they will have the same visual appearance. The document assembler may compare the augmented electronic document to the assembled hard copy

30   document to proofread for mistakes. Since both the user and the document assembler view the same augmented electronic document, the user is assured that the assembled paper document

will have the intended visual appearance.

Referring to FIG. 3, a computer system 30 for running a virtual document assembly program 32 includes a general purpose programmable digital computer 34 (such as a personal

5 computer or work station), a mass storage device 36 (such as a hard disk drive), a keyboard 38, a pointer device 46 (such as a mouse), and a display 40 with a screen 104 for displaying the augmented electronic document. The computer 34 is of conventional construction, and includes a memory and a processor (not shown). Computer system 30 may also include communications hardware and software (not shown) by which the computer system may be connected to another

10 computer 44 by an intranetwork or internetwork link 42.

The virtual document assembly program 32 creates and displays the augmented electronic document 120. Referring to FIG. 4, the virtual document assembly program 32 includes a user interface 50, a rendering procedure 52, and a PDF file editor 56. The PDF file editor is used to add instructions to the pages of the PDF document to generate the augmented

15 electronic document, whereas the rendering procedure is used to display the augmented electronic document on the computer screen. The program 32 may be centralized on a single computer, or it may be distributed across a computer network. The program 32 may also include or be associated with a database 54 containing permissible document assembly parameters and associated instructions for the rendering procedure 52. The database includes two types of

20 permissible document assembly parameters: those parameters that require a specialized function of the rendering procedure 52 (such as cutting and folding), and those parameters that can be illustrated by overlaying (or "tiling") one or more images on the page (most other parameters). For the parameters that can be illustrated by tiling, each entry 60 in the database 54 includes a parameter name 62, a set of tiling instructions 64, image files 66 to be used in the tiling, and an

25 optional icon 68 for use in displaying a list of the parameters. For the parameters that require a specialized function of the reading program, the entry 60 may include only the parameter name. The parameter names 62 may be organized into classes (e.g., bindings, cover sheets, paper color, etc.) that will be used by the use interface in displaying the document assembly form.

Referring to FIGS. 4 and 5, a method 70 performed by the virtual document assembly

30 program begins by opening the PDF document that was selected by the user (step 72). When the user decides to assemble the electronic document, the program 32 generates a list of

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document assembly parameters (step 74) and displays the list (step 76) in the document assembly form. In order to generate the list of document assembly parameters, the user interface 50 searches and lists the parameter name 62 for each entry 60 from the database 54. The user interface 50 may use the classes of the parameters names 61 in order to determine how to format the document assembly form, or otherwise improve the visual display. Once the program 32 receives user input selecting various document assembly parameters (step 78), the PDF file editor 56 modifies a copy of the original PDF document to generate the augmented electronic document 120 (step 80). Specifically, the PDF file editor adds the necessary graphic elements to provide the visual appearance of a paper document assembled according to the document assembly parameters. The original PDF document is saved for transmission to the document assembler. For example, the PDF document may be loaded into memory, modified by the PDF file editor, and the modified document in memory may be saved as a separate file.

In brief, returning to FIG. 4, the PDF file editor 56 uses the tiling instructions 64 associated with the selected parameter name 62 from the database 54 to append instructions to each page of PDF document 106. There are four entries in each set of tiling instructions 64; one for the front cover, one for the inside left pages, one for the inside right pages, and one for the back cover. Each tiling instruction includes the size of the tile, the number and spacing of the tiles, and the position of the tiles on the page. Image file 66 contains the tile images. These instructions may be expressed in the conventional PDF format.

As an example, referring to FIGS. 2D-2F, for a document assembly parameter corresponding to a staple, the tiling instructions 64 would include the following entries: for the first page, overlay a short diagonal segment in the upper left-hand corner of the page; for the inside-left pages, overlay a triangular shaded area in the upper right hand corner of the page; for the inside-left pages, overlay a triangular shaded area in the upper right hand corner of the page; and for the last page, overlay two short diagonal segments in the upper right-hand corner of the page.

Referring to FIG. 6, modifying the PDF document (step 80 in FIG. 5) will be explained in greater detail. The PDF file editor begins by adding a front cover to the document (step 90). The front cover is formed as a blank page to which the cover sheet parameters and the first-page tiling instructions are applied. If there is no front cover, then the first-page tiling instructions are

applied to the first page of the document. Then the PDF file editor determines (e.g., from the source document) whether the document is double-sided (step 92). If the document is double sided, the tiling instructions for the inside right page are applied to each odd page (step 94a), and

5   the tiling instructions for the inside left pages are applied to each even page (step 96a). On the other hand, if the document is to be single-sided, the PDF file editor applies the inside right page tiling instructions to the pages from the PDF document (step 94b). In addition, the PDF file editor interleaves blank pages with the original pages and applies the tiling instructions for the inside left page to the blank pages (step 96b). Once the inside pages have been modified, the

10   PDF file editor may add a back cover page to which the back cover tiling instructions are applied (step 98). Of course, the ordering of the steps discussed above is exemplary. For example, tiles could be applied to the inside pages after the back cover page is added.

In order to determine which tiling instruction takes precedence when modifying the PDF document, the PDF file editor divides the document into five layers: organizational information

15   (e.g., side by side display, folding, double-sided), background (e.g., the color, texture, watermarks of the printed media), printed content (e.g., text, graphics and images from the source document), virtual proof annotations (e.g., cut marks), and finishing options (e.g., drilling, bindings). Tiling effects are given precedence so that the last layer in the above list, i.e., finishing options, is the last applied. This order of precedence may be captured as part of the

20   tiling instructions. The organizational information is appended to the PDF document to be used by the rendering procedure.

The effects that cannot be achieved by tiling (such as cutting and folding) have dedicated procedures in the PDF file editor 54. For example, to generate a cut, the PDF file editor 54 retrieves the location and direction of the cut from the document assembly parameters. For each

25   page that has been cut, the PDF file editor 54 generates two sub-pages corresponding to the portions of the original page on the two sides of the cut. The page of the augmented electronic document is resized, and the sub-pages are pasted onto the resized page so that they are separated by a gap. To generate a folded page, the PDF file editor 54 retrieves the location, direction and angle of fold from the selected document assembly parameter. Then the PDF file

30   editor 54 divides the folded page into sub-pages corresponding to the flaps of the fold. The PDF file editor 54 skews each sub-page to simulate the angle of fold, and then overlays the skewed

sub-pages in the proper order to generate a new image. The page of the augmented electronic document is resized, if necessary, and the new image is pasted onto the resized page.

Returning to FIGS. 4 and 5, once the PDF document has been modified, the rendering procedure 52 in the virtual document assembly program 32 renders and displays the augmented electronic document (step 82). Because the augmented electronic document 120 is a conventional PDF file, the techniques of a conventional PDF document viewer, such as Adobe Acrobat™, may be used to display the pages from the assembled document.

Once the augmented electronic document is displayed, if the user decides to add, delete or change the document assembly parameters (step 84), the virtual document assembly program 32 redisplays the list of document assembly parameters (returning to step 76). Otherwise, the program 32 saves the electronic document with the selected document assembly parameters, or the augmented electronic document 120 itself, in mass storage (step 86).

What is claimed is: